

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Reissue Application of:)	
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U.S. Patent No. 5,803,975, issued 09/08/98)	Examiner: Luz L. Alejandro
	:	
NOBUMASA SUZUKI)	
	:	Group Art Unit: 1763
Application No.: 09/657,971)	
	:	
Filed: September 8, 2000)	
	:	
For: MICROWAVE PLASMA)	
PROCESSING APPARATUS	:	
AND METHOD THEREFOR)	

Commissioner for Patents
Washington, D.C. 20231

DECLARATION UNDER TITLE 37 C.F.R. §1.132

I, Nobumasa Suzuki, declare that:

1. I reside at 302 Canon Utsunomiyadainiheights, 8-10,
Higashishukugo 1-Chome, Utsunomiya-shi, Tochigi-ken, Japan.
2. I have been employed at Canon Kabushiki Kaisha since 1981 and have
worked in the field of developing microwave plasma apparatus since 1992.
3. I have received a Doctor of Engineering degree from Tohoku University.

4. I have received eight United States patents in the field of microwave plasma apparatus, namely: U.S. Pat. Nos. 5,487,875; 5,538,699; 5,803,975; 5,983,829; 5,985,091; 6,007,878; 6,080,679; and 6,238,527.

I have also published the following three papers:

1) N. Suzuki, K. Masu and K. Tsubouchi, "Silicon Dioxide Film Deposition by Photoassisted Microwave Plasma CVD Using TEOS," Appl. Surf. Sci. 79/80 (1994), pp. 327-31;

2) N. Suzuki, S. Hayashi, K. Masu and K. Tsubouchi, "High-Rate Deposition of High-Quality Silicon Nitride Film at Room Temperature by Quasi-Remote Plasma CVD," Jpn. J. Appl. Phys. Vol. 34 (1995), pp. 230-32; and

3) N. Suzuki, H. Kitagawa and S. Uchiyama, "Stable Surface-Wave Plasma through Excitation of Standing Surface-Wave Using Plane Multislot Antenna," Jpn. J. Appl. Phys. Vol. 41 (2002), pp. 3930-35.

5. I am the inventor of the subject patent application and am familiar with the prosecution history of the subject patent application.

6. I have conducted a comparison test using computer simulation that compares a filled waveguide, similar in structure to the endless annular waveguide of the present invention, to an unfilled waveguide that differs from the filled waveguide in that no second dielectric material is inserted into the waveguide tube. Otherwise, the waveguides are physically identical. The computer simulation test compares the effect of the slot numbers in the filled waveguide and in the unfilled waveguide on the density and uniformity of the plasma formed.

7. The comparison test uses a filled waveguide that has a structure similar to the waveguide shown in Figure 7 of the instant application and described in Embodiment 5 of the instant specification (beginning at page 22, line 15 and ending on page 24, line 10) with the exceptions that the annular waveguide tube that is used in the comparison test (labeled 103 in Figure 7 of the instant application) has a central diameter of 303 mm and the second dielectric material (labeled 704 in Figure 7 of the instant application) that is used for the filled waveguide is Teflon with a dielectric constant of 1.7. The comparison test uses AlN with a dielectric constant of 11.2, as the first dielectric material (labeled 102 in Figure 7 of the instant application). Otherwise, the comparison test employs the same waveguide tube as in the instant specification.

8. The computer simulation was carried out using simulation software JMAG-WV on a HP UX/WS C160 computer. The computer simulation relied on an established Maxwell equation and on the assumption that a plasma of an electron density $2.0 \times 10^{12}/\text{cm}^3$ was generated in the filled and unfilled waveguides respectively. The strength and uniformity of the surface wave electric field generated on the surface of the AlN electric tube is compared for the filled and unfilled waveguides.

9. The comparison test shows that the filled waveguide generates therein a standing wave having a wavelength of 105.9 mm and has 18 slots formed at equal intervals in the inside wall of the waveguide tube (see Common Slot and Slot for Filled Waveguide in the Figure labeled "Structures of CMA for Simulation for Comparing Absence/Presence of 2nd Dielectric Material," hereinafter referred to as "Fig. A"). The comparison unfilled waveguide generates a standing wave having a wavelength of 158.8 mm and has 12 slots formed at equal

intervals in the inside wall of the waveguide tube (see Common Slot and Slot for Not Filled Waveguide in Fig. A). The presence of a second dielectric material in the filled waveguide generates a standing wave of a shorter wavelength than that of the standing wave in the unfilled waveguide, which allows for a reduction of distance between slots.

10. The shorter wavelength of the standing wave in the filled waveguide results in 9 waveguide peaks around the length of the filled waveguide tube in comparison with 6 waveguide peaks around the length of the unfilled waveguide tube (see color Figure labeled “Top View”).

11. The comparison test shows that the standing wave’s electric field generated on the inner face of the dielectric tube is much stronger in the filled waveguide tube than in the unfilled waveguide tube (see color Figures labeled “Oblique View” and “Inner Side View”). The average of the peak strength of the loops in the filled waveguide is 1.7 times the average of the peak strength of the loops in the unfilled waveguide.

12. Further, the comparison test shows that the standing wave’s electric field generated on the inner face of the dielectric tube is more uniform in the filled waveguide tube than in the unfilled waveguide tube (see color Figures labeled “Oblique View” and “Inner Side View”). The average of the peak uniformity of the loops in the filled waveguide is greatly improved from +/- 21% for the unfilled waveguide to +/- 4% for the filled waveguide.

13. As described above, the presence of a second dielectric material in a multi-slotted annular waveguide reduces the standing wavelength, which, in turn, allows for a

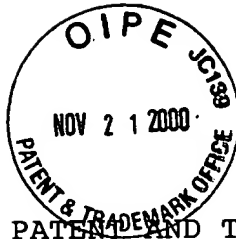
reduction in the inter-slot distance and ultimately permits an increase in slot density, while providing enhanced peak strength and uniformity. The comparative test results between the filled waveguide tube and the unfilled waveguide tube show that suitably defining the dielectric constant and the dimensions of the waveguide effectively contributes to efficient excitation of surface standing waves.

I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Subscribed this 15th day of November 2002.

Nobumasa Suzuki
Nobumasa Suzuki

35.C11969 REI.



PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Reissue Application:)	Previous
of U.S. Patent No. 5,803,975	:	Examiner: L. Alejandro
)	
Applicant: NOBUMASA SUZUKI	:	
)	Group Art Unit: 1763
Appln No.: 09/657,971	:	
)	
Filed: September 8, 2000	:	
)	
For: MICROWAVE PLASMA	:	
PROCESSING APPARATUS AND)	
METHOD THEREFOR	:	November 1, 2000
)	
Issued: September 8, 1998	:	

Commissioner for Patents
Washington, D.C. 20231

ATTENTION: BOX MISSING PARTS

REISSUE DECLARATION AND POWER OF ATTORNEY

Sir:

As the below named inventor, I hereby declare and say
that:

1. I believe that I am the original, first and sole
inventor of the subject matter which is claimed in the subject
reissue application and for which a reissue patent is sought on
the invention entitled MICROWAVE PLASMA PROCESSING APPARATUS AND
METHOD THEREFOR, the specification of which was filed in the
Patent and Trademark Office on September 8, 2000.

2. I have reviewed and understand the contents of the reissue application, including the claims.

3. I acknowledge my duty to disclose to the U.S. Patent and Trademark Office all information known to be material to patentability as defined in 37 C.F.R. § 1.56.

4. I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) or §365(b), of the foreign applications for patent identified below and have also identified below any foreign application for patent or inventor's certificate or PCT international application having a filing date before that of the application on which priority is claimed:

<u>Country</u>	<u>Application No.</u>	<u>Filing Date</u>	<u>Priority Claimed</u>
Japan	8-044884	March 1, 1996	Yes
Japan	8-057288	March 14, 1996	Yes

5. I believe that the original above-identified U.S. Patent is partly inoperative by reason of my having claimed less than I had the right to claim; specifically, issued claims 19-25 and 50-59 are more narrow than the invention I disclosed in the patent by requiring the presence of a processing chamber recited in independent claims 19 and 50. Additionally, claims to certain specific embodiments disclosed in my application are not included in the issued patent. Accordingly, new Claims 60-98 should be

included in the patent in order to provide me with claims of both broader scope and more specific scope, consistent with my invention and my disclosure. During the prosecution of U.S. Patent Application No. 08/806,070, which matured into the above-identified U.S. Patent, claims of the scope of these new claims were not presented.

6. The errors to be remedied by this reissue application arose due to the failure to appreciate that the claims directed to an embodiment of my invention were written more narrowly than the scope of my actual invention as disclosed in the originally filed application.

7. All errors which are being corrected in the present reissue application up to the time of filing this declaration arose without any deceptive intent on my part.

8. I hereby appoint the practitioners associated with the firm and Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and direct that all correspondence be addressed to the address associated with that Customer Number:

FITZPATRICK, CELLA, HARDER & SCINTO

Customer Number: 05514.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Sole Inventor NOBUMASA SUZUKI

Inventor's signature Nobumasa Suzuki

Date November 1, 2000 Citizen/Subject of JAPAN

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